MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

EME1016 – APPLIED STATICS

(ME)

13 OCTOBER 2016
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 7 pages with 4 Questions.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) **Figure 1** shows a hook which is mounted on a wall at point *O*. Two loads, m_1 and m_2, are to be hung from the hook at points *A* and *B*, respectively. For safe use of the hook, the hook can only take a maximum total weight load of 3 N, *or* a maximum total bending load of 0.1 N·m at point *O*.

Determine the maximum amount of m_1 which can be hung from the hook **without going over either load limit**. (Consider gravitational acceleration to be 9.81 N/kg. The effect of the weight of the hook has been factored into m_1 and m_2.)

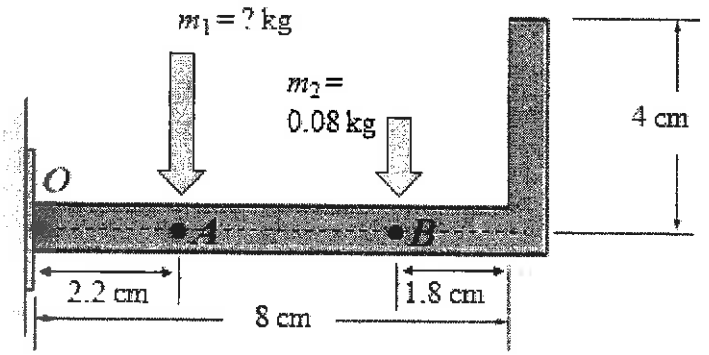

Figure 1

[9 marks]

Continued ...

(b) **Figure 2** shows a pipe installation being gripped with two monkey wrenches, with section *BC* about to be loosened. The entire system is considered to be static in this moment.

Determine the force and moment reactions at point *O*. Indicate their directions as well. (Disregard the weight of the pipe installation. The effect of the weight of the wrenches has been included in the forces F_1 and F_2.)

(Note: In the case of the moment reaction, there should be a sketch showing the direction of the reaction.)

[16 marks]

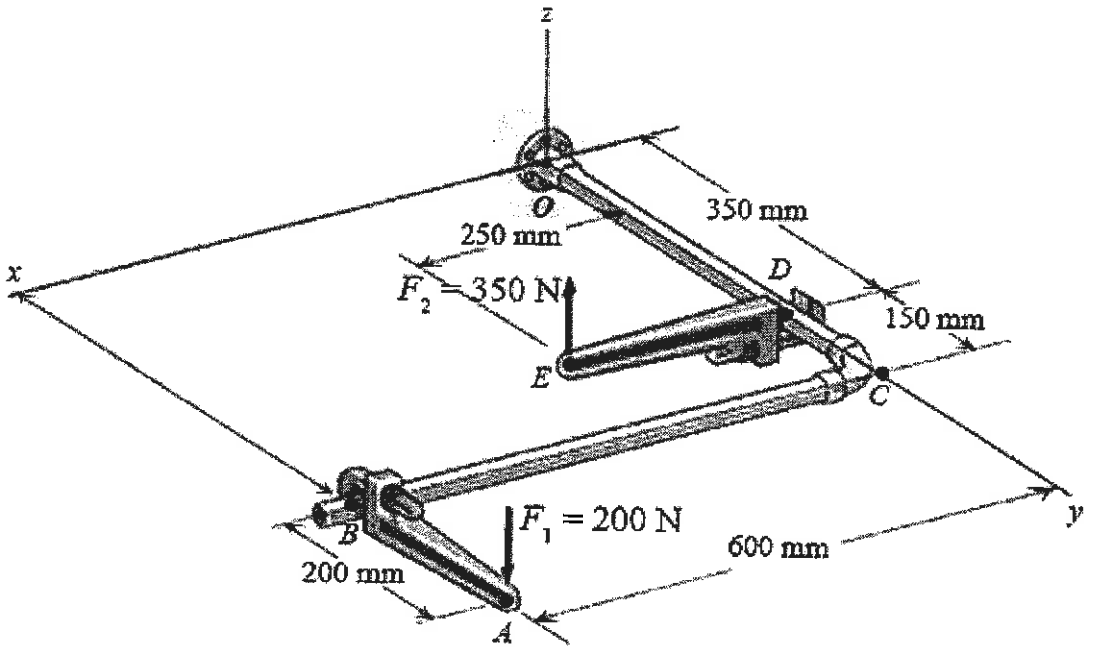

Figure 2

Continued ...

Question 2

(a) **Figure 3** shows the side view of a bench which has been mounted against the wall and the floor with the hinges E and A respectively. The bench is represented as a rigid structure with two members AB and BE. Two loads F_C and F_D have been placed at points C and D respectively.

(i) Determine the reactions at hinges at A and E. (Hint: Member AB is a two-force member; member BE is not.)

[10 marks]

(ii) Determine the internal force within the member AB.

[2 marks]

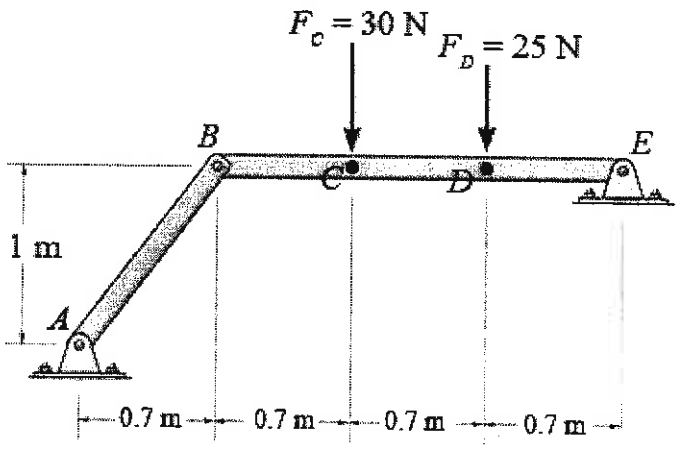

Figure 3

Continued ...

(b) **Figure 4** shows a rigid truss which is being used to balance the load W with P. For the load to be balanced without the truss tipping over to the left, i.e. rotating about B, the magnitude of the reaction from the wheeled support at C must be non-zero.

(i) Determine the range of the magnitude of P to achieve this.

[7 marks]

(ii) Determine the internal force in the two-force member FE, BE and BC. (Express them in terms of P where it is not possible to obtain exact values.)

[5 marks]

(iii) Among members FE, BE and BC, state the member which has an internal force that may change in direction as P changes in magnitude.
Then, determine the magnitude of P at the onset of this change in direction.

[1 mark]

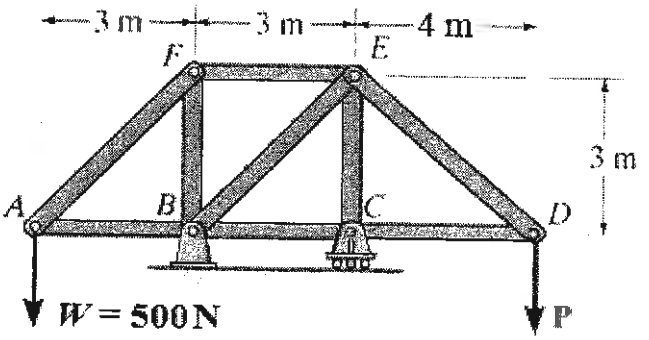

Figure 4

Continued ...

Question 3

For the composite area as shown in **Figure 5**;

(a) Determine the centroid ($\bar{x}$ & $\bar{y}$) of the composite area. [15 marks]

(b) Determine the moment of inertia ($\bar{I}_{x'}$) about the ***x'*** centroidal axis. [10 marks]

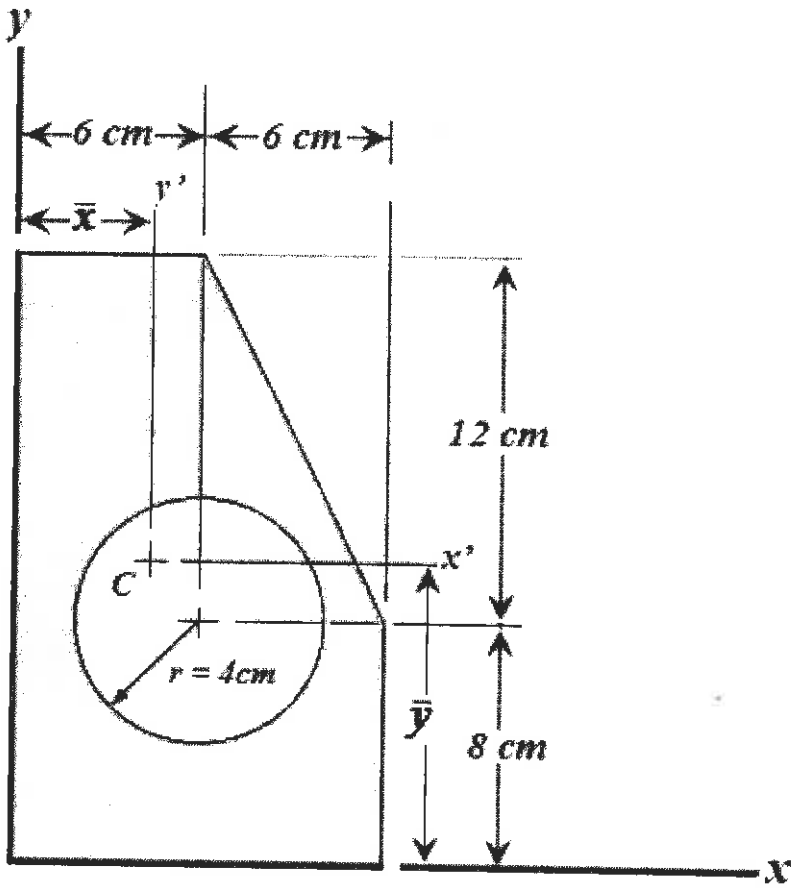

Figure 5

Continued ...

Question 4

(a) Determine the maximum angle θ, which the adjustable incline may have with the horizontal, before the block of mass m, as shown in **Figure 6**, begins to slip. The coefficient of static friction between the block and the inclined surface is μ_s.

[10 marks]

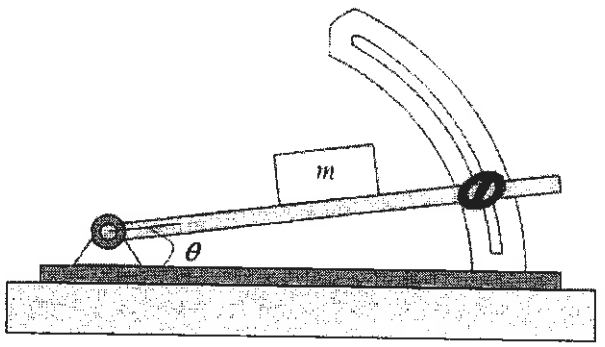

Figure 6

(b) The crate has a mass 175kg and is subjected to a towing force **P** acting at an angle $\theta = 30°$ with the horizontal as shown in **Figure 7**. If the coefficient of static friction is $\mu_s = 0.3$,

(i) Draw the free body diagram of the crate.

[5 marks]

(ii) Determine the magnitude of **P** to just start the crate moving down the plane and the normal force (N_c) acting on the crate.

[10 marks]

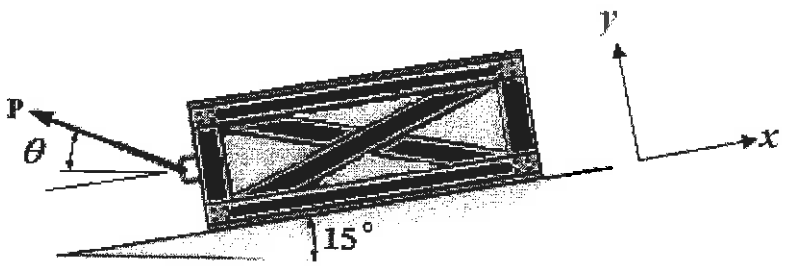

Figure 7

Continued ...

Appendix - Equations

Moment generated by a force	$\boldsymbol{M} = \boldsymbol{r} \times \boldsymbol{F}$
Equilibrium of forces	$\Sigma \boldsymbol{F} = 0$
Equilibrium of moments	$\Sigma \boldsymbol{M} = \Sigma(\boldsymbol{r} \times \boldsymbol{F}) = 0$
Tangent of a Pythagorean triangle with sides y and x	$\tan\theta = \frac{y}{x}$

End of Paper